ELSEVIER

Letter to the Editor

To the Editor:

The word essential is used to indicate a requirement for life of all cells, and the word metalloelement is used in preference to the words metal, metal ions, and minerals which often do not convey the intended meaning. In biological systems they are not metallic, their predominant forms are not ionic, and they are not naturally occurring minerals. Use of the word "metalloelement" is also consistent with other current word usage, e.g., metalloenzyme, metalloprotein, and metallothioneine.

Use of ionically bonded inorganic salt forms of essential metalloelements such as sulfates, nitrates, and chlorides to study metalloelement-mediated biological events seems most inappropriate, while using small molecular mass complexes or chelates seems most appropriate. These complexes or chelates are advantageous in that they are biologically relevant forms of these metalloelements and physiological concentrations produce noteworthy pharmacological effects.[1,2]

Principal forms of essential metalloelements in vivo are metalloelement-dependent enzymes, proteins, nucleic acids, and low molecular mass complexes or chelates. These proteins and low molecular mass ligands actually protect cellular components from the relatively large amounts of these metalloelements found in cells and enable their use in accomplishing biochemical transformations.

Aquated ionically bonded compounds account for a very small, but not unimportant, fraction of the total essential metalloelement content of tissues. Concentrations of ionically bonded Cu(II), 10^{-18} M, Fe(III), 10^{-23} M, Mn(II), 10^{-12} M, and Zn(II), 10^{-9} M, in plasma are too small to be measured accurately with existing methods and are calculated values.[3,4] Concentrations of these ionically bonded essential metalloelements in solid tissues are likely to be much smaller due to the greater abundance of covalent and coordinate-covalent bonding ligands. Consequently, all measurable quantities of these essential metalloelements in tissues are low molecular mass complexes or chelates and metalloelement-dependent enzymes, proteins, and nucleic acids.

Essential metalloelement-dependent enzymes, proteins, and nucleic acids as well as low molecular mass complexes or chelates are much more stable forms of these metalloelements in biological systems than ionically bonded forms. Ionically bonded forms of these metalloelements when added to biological systems lead to the immediate formation of protein or low molecular mass ligand complexes in these systems. Mixing ionically bonded forms of metalloelements with ligands prior to their addition to biological systems at pH values required to maintain solutions give species that may be nearly as reactive as the parent ionically bonded metalloelement. The in situ formation of complexes with vital proteins in these systems is well known to seriously compromise the functioning of these systems. In all such events, biological results obtained with these additions are so indistinct as to make it impossible to offer reasonable consequential interpretations of these inappropriate additions which are often incorrectly interpreted as radical-mediated events.

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